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Full Length Research

Flooding Effects on Developed Property Values in Port Harcourt Metropolis Rivers State, Nigeria

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This research examined the effects of flooding on developed property values in Port Harcourt Metropolis, Rivers State, Nigeria. The methodology involved the sub-dividing of the Metropolis into four sub basins (SB1, SB2, SB3, SB4) with the aid of the topographic map of Rivers State. Data collection was by means of primary and secondary sources of information. Three hundred and sixty respondents were selected and interviewed using a pre-coded questionnaire, as well as field measurements. Descriptive statistics such as frequency and percentages were used as well as inferential statistics such as Spearman's rank statistics was also used for data analysis. Findings showed that about 51.9% of respondents agreed that there was flooding problems in Port Harcourt Metropolis. However, 43.1% attested that the flood water lasts up to 30 days before the water dries up. On developed property values the study found that (61.1%) of respondents affirmed that flooded properties were abandoned during and after flooding. Also (20.8%) of respondents agreed that the buildings within these flooded areas have depreciated in structure and value, while (18.1%) affirmed that the rent were low in such flooded areas. Drainages were available, but substandard, therefore blocked with debris and could not evacuate storm water. Statistical test of the degree of relationship proved that there was a very strong relationship between flood frequency and drainage condition in the Metropolis (P<0.01 (n=40). The study recommended that government should prepare a drainage plan for the Metropolis. Furthermore, a comprehensive drainage and infrastructural planning works should be embarked upon urgently by the relevant agencies by way of de-silting all drainages and waterways, identification and demolition of structures on flood plains and construction of storm water channels in flood prone areas to combat the menace of flooding in the Metropolis.

Key words: Flooding Effects, Developed Property, Values, Port Harcourt.

INTRODUCTION

Port Harcourt city, the hub of oil and gas activities in Nigeria, has experienced an accelerated growth in population and other infrastructural development since its establishment in 1912. This has greatly resulted in the alteration of its original structure and land use. Ogionwo (1979) substantiated this fact when said that every day; the surface of the city is being gouged out, lifted up and placed back

together, limited access highways, tall office buildings and apartments, a sprawling array of factories, are all symbols of technological advance that brings with it unimagined and unmeasured consequences. One of such immeasurable consequences as described by Gobo (1990) is exacerbated by excessive rainfall and consequent reduction in the infiltration capacity of the soil due to its low permeability. The natural factors are prolonged rainfalls, poor management of flood plains and wetlands, human factors are urbanization, failure in engineering flood control structures (drainages) and devastation of flood plains and wet lands by man (Elenwo and Efe, 2014). Flooding is experienced in most homes during the rainy season, on a typical flooded day in the city; roads are rendered impassable both to human and vehicular traffic. Properties are damaged as a result losing value, and occupants are forced to vacate their homes and occasionally lives are made difficult for some times due to economic effects of the loss (Nasiri et al., 2016). Furthermore, the effect of flood on the residents of the city of Port Harcourt especially property owners is such that many lives are lost and property worth millions damaged (Oku et al., 2011). According to (Elenwo, 2015), the losses recorded as a result of flooding in the city are enormous; the destructions are complete or partial impairment of values on properties, goods and services. Flooding in the Metropolis was exacerbated by erection of illegal structures or buildings on water channels and the impacts on the environment especially on developed property values was the focus of this study. The following research questionnaire was generated for the study:

(a) What are the frequency and duration of flooding in Port Harcourt Metropolis?
(b) What types of drainage systems are available in Port Harcourt Metropolis?
(c) What are the conditions of the drainages in Port Harcourt Metropolis?
(d) What are the rent charges on developed property affected by flooding in the Metropolis?
(e) What are the structural/erosional damage arising from the flooding and flood depth?
(f) To what extent do frequency of flooding influence the value of developed properties in the Metropolis?
(g) To what extent did drainage conditions, location of houses and rainfall intensities affect flood frequency?

Aim and Objectives of the Study

The aim of this study is to examine flooding effects on developed property values in Port Harcourt Metropolis Rivers State, Nigeria.

The aim was achieved by the following identified objectives as follows:

(i) To Examine the frequency and duration of flooding in Port Harcourt Metropolis
(ii) To Examine the availability of drainage in Port Harcourt Metropolis
(iii) To Investigate the conditions of drainages in Port Harcourt Metropolis
(iv) To Examine the rent charges on developed properties affected by flooding in the Metropolis
(v) What are the structural/erosional damage arising from the flooding and flood depth?
(vi) To Determine the relationship between frequency of flooding and the value of developed properties in the metropolis?
(vi) To Determine the relationship between drainage conditions, location of houses and rainfall intensities and flood frequency.

Research Hypothesis Statement

The following hypothesis was tested in this study:

1. There is no statistically significant relationship between the frequency of flooding in Port Harcourt Metropolis and the value of Properties.
2. There is no statistically significant relationship between flood frequencies and drainage conditions, location of structures and rainfall intensity.

METHODOLOGY

There was initial reconnaissance survey to delineate areas to be designated as the boundaries of sub basins. Port Harcourt was subdivided into four sub basin areas using the Shell Petroleum Development Company street map scale (1:20, 000) of Port Harcourt and the topographic maps of Port Harcourt from the survey Division, Ministry of Urban Development Rivers State. The latter formed the base maps. The sub basins are smaller part of the larger Niger Delta, using the existing rivers that drain the city, the Bonny River, Diobu Creek, Amadi

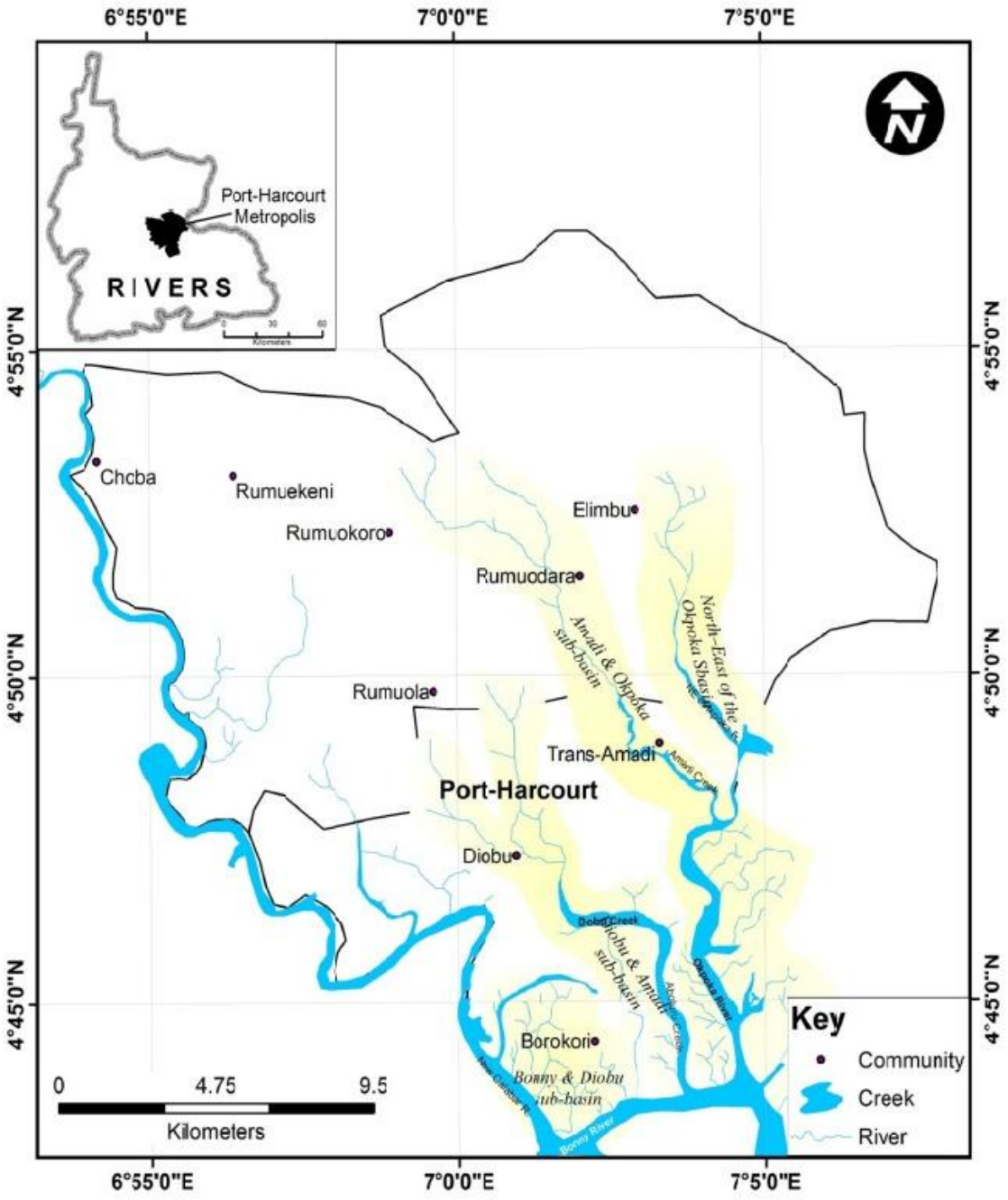

Figure 1. Port Harcourt Metropolis showing the four major sub-basins. Source: GEM Cartography Laboratory, 2018.

Creek and Okpoka River, Figure 1 above shows the major sub basins in Port Harcourt Metropolis.
The sub basins are;
SB1: The area bounded by Bonny and Diobu Creek
SB2: The area bounded by Diobu Creek and Amadi Creek.
BS3: The area bounded by Amadi Creek and Okpoka River.
SB4: The area on the North –East of the Okpoka River.

Sample and Sampling Technique: Sample is a small group of elements or subjects that represents the entire population. Within these sub basins, the

Table 1. Frequency of flooding in Port Harcourt Metropolis.

Frequency of flooding	SB1		SB2		SB3		SB4		Row Total	
	N	%	N	%	N	%	N	%	N	%
1 – 3 times	5	5.5	10	11.1	5	5.5	0	00	20	5.6
4 – 6 times	10	11.1	10	11.1	10	11.1	10	11.1	40	11.1
7-9 times	10	11.1	10	11.1	15	16.6	10	11.1	45	12.5
10 times plus	15	16.6	18	20.0	10	11.1	20	22.2	63	17.5
All through season	45	50.0	42	46.7	50	55.6	50	55.6	187	51.9
Not-applicable	5	5.5	0	0	0	0	0	00	5	1.4
Total	90	100	90	100	90	100	90	100	360	100

street map of Port Harcourt was super imposed on the SPDC map to select streets for the sample. Using the stratified random sampling technique, two streets each were chosen, from which houses were systematically chosen for questionnaire administration. Port Harcourt Metropolis as recorded by National Bureau of Statistics, 2006 is about, 1,382,592 persons which was used to estimate the sample size. Sample size was estimated at 95% confidence interval using the Yamane Taro (1967); equation; n = $\frac{N}{1+N\alpha^2}$

Where;

n= sample size

N= total number of teachers in primary and secondary schools across port Harcourt city

α= 0.05

n= $\frac{1,382,592}{1+1,382,592(0.05)^2}$ = 400.00

Data Collection/ Instrumentation: The data for this research were collected from secondary and primary sources. The primary sources included the use of pre-coded questionnaire which was administered by means of face to face interview with respondents. A total number of 400 questionnaires were distributed to the sub basins to elicit answers from respondents. At the end of the interview, about three hundred and sixty (360) copies of questionnaires were properly filled and retrieved for the research, ninety from each sub basin. Direct measurement of flood depth was done on a typical flood day to ascertain the depth of flood in the affected sub basins. Secondary sources included published and unpublished information such as the Master Plan of Port Harcourt (1975, maps from Shell showing the streets in Port Harcourt).

Analytical Techniques: Descriptive statistics and inferential statistics were employed in the study for analysis. Descriptive statistics was expressed in terms of frequencies and percentages while inferential statistics involved the use of Spearman's rank statistics to test the hypotheses formulated for the study. Spearman's rank statistics was used because of its capability to handle non-parametric data to show the associations between a dependent and independent variables.

RESULTS

The Table1 shows the frequency of flooding in Port Harcourt Metropolis. Obviously from respondents, the assertion was that about 51.9% of them say the flood situation were experienced all through the period of rainy season, only a negligible number 1.4% say they were not applicable. Previous research by (Uchegbu, 2003) confirms this assertion that it is an annual occurrence.

The Table 2 raises the question on the duration of the flood incidence in Port Harcourt Metropolis. From respondents' answers, we deduce that 43.1% are in affirmative that the flood lasts over one month when it occurs before the water dries up. A glance at the above table as revealed by the respondents shows that the situation is the same during the rainy season in the sub basins. The overall effects on the Metropolis include disruption of business, social activities, chaotic traffic situation and stoppage of developmental activities and inundation of residential areas.

Tables 3 and 4 examined the availability of drainages and the conditions of these drains. The information was also observed by the researcher by

Table 2. Duration of Flood in Port Harcourt Metropolis.

Period of flooding	SB1		SB2		SB3		SB4		Row Total	
	N	%	N	%	N	%	N	%	N	%
Less than 12hr.after rainfall	5	5.5	5	5.5	5	5.5	5	5.5	20	5.5
12-24hrs.	10	11.1	5	5.5	10	11.1	5	5.5	30	8.3
2 -7 days	5	5.5	12	13.3	5	5.5	10	11.1	32	8.9
7 – 14 days	10	11.1	10	11.1	10	11.1	10	11.1	40	11.1
14-21 days	10	11.1	10	11.1	10	11.1	10	11.1	40	11.1
21-28 days	10	11.1	13	14.4	10	11.1	10	11.1	43	11.9
Over one month	40	44.5	35	39.8	40	44.5	40	44.5	155	43.1
Total	90	100	90	100	90	100	90	100	360	100

Table 3. Availability of Drainages in Port Harcourt Metropolis.

Availability of Drainages	SB1		SB2		SB3		SB 4		Row total	
	N	%	N	%	N	%	N	%	N	%
Yes	75	83.3	65	72.2	60	66.6	70	77.7	270	75
No	10	11.1	10	11.1	20	22.2	20	22.2	60	16.6
Not applicable	5	5.5	15	16.6	10	11.1	-	-	30	8.3
Total	90	100	90	100	90	100	90	100	360	100

Table 4. Conditions of Drainages in Port Harcourt Metropolis.

Conditions of Drains	SB1		SB2		SB3		SB 4		Row total	
	N	%	N	%	N	%	N	%	N	%
Drains available and flowing	12	13.3	20	22.2	18	20.0	10	11.1	60	16.7
Drains available but sub-standard	50	55.5	60	66.7	62	68.8	70	77.8	242	67.2
Drains not available	28	31.1	5	5.5	5	5.5	10	11.1	48	13.3
Not applicable	-	-	5	5.5	5	5.5	-		10	2.7
Total	90	100	90	100	90	100	90	100	360	100

direct observation in the field. The confirmation from the respondent shows that about 75% say that drainages are available, while in Table 4 they affirmed that the drainages are substandard (67.2%) and not deep enough to carry away heavy storm water during rainfall, the condition of the drainages Table 4. This confirms the affirmation in Table 1 on the frequency of flooding that last for months in the Metropolis and also the clay texture of the soil formation as confirmed by Chiadikobi et al., (2011).

The analysis in Table 5 shows that the respondents admit that residents of the Metropolis occupy more of the self-contain apartments (29.2%), followed by one bed-room apartment (20.8%), then two bedroom apartment (14.7%), while bungalow (12.7%) and duplexes (11.6%) were on owner occupier bases in different sub basin in the Port Harcourt Metropolis.

The Table 6 shows the effect of flooding on property value in the Metropolis. A glance at the table shows that about (61.1%) of respondents affirm that the flooded houses were abandoned during and after flooding, (20.8%) of the respondents say the buildings within these flooded areas have depreciated in structure and value, while (18.1%) say that the rent were low in such flood

Table 5. Rent charges on property affected by flooding in the Metropolis.

Building types/charges	SB1		SB2		SB3		SB4		Row Total	
	N	%	N	%	N	%	N	%	N	%
Self-Contain(#90,000-#100,000)	50	55.5	10	11.1	10	11.1	35	38.8	105	29.2
One-bedroom (#350,000-#400,000)	30	33.3	10	11.1	10	11.1	25	27.7	75	20.8
Two-bedroom (#450,000-#600,000)	5	5.6	20	22.2	18	20.0	10	11.1	53	14.7
Three-bed room(#700,000-#800,000)	5	5.6	20	22.2	7	7.7	7	7.7	39	10.8
Bungalow (#800,000-#1M	0	0	15	16.6	23	25.5	8	8.8	46	12.7
Duplex(#1.5m-#2M)	0	0	15	16.6	22	24.4	5	5.5	42	11.6
Total	90	100	90	100	90	100	90	100	360	100

Table 6. Effect of flooding on property values (low-charges, abandonment, and depreciation) in the Metropolis.

Effects of Flooding on Property	SB1		SB2		SB3		SB 4		Row total	
	N	%	N	%	N	%	N	%	N	%
Abandonment	55	62.1	65	72.2	50	55.5	50	55.5	220	61.1
Depreciation	25	27.7	10	11.1	20	22.2	20	22.2	75	20.8
Low charges	10	11.1	15	16.6	20	22.2	20	22.2	65	18.1
Total	90	100	90	100	90	100	90	100	360	100

Table 7. Measures taken to combat flooding in Port Harcourt Metropolis.

Measures to combat flooding	SB1		SB2		SB3		SB4		Row Total	
	N	%	N	%	N	%	N	%	N	%
Built-high pavements-at entrance-to houses	5	5.6	5	5.6	10	11.1	5	5.6	25	6.9
Bailing out water	5	5.6	5	5.6	10	11.1	5	5.6	25	6.9
Construction of channels	20	22.2	20	22.2	20	22.2	25	27.8	85	23.6
Cleaning/Desilting of drainages	20	22.2	20	22.2	20	22.2	15	16.6	75	20.8
Seeking alternative accommodation	20	22.2	20	22.2	20	22.2	20	22.2	80	22.2
Abandon building	20	22.2	20	22.2	10	11.1	20	22.2	70	19.4
Total	90	100	90	100	90	100	90	100	360	100

areas in the Metropolis.

The analysis in Table 7 revealed that (6.9%) of respondents built high wall at entrances as well as bail out water during flooding in the Metropolis. Others include government engage on cleaning of their drainages (de-silting of drains) 20.8% as well as construction of channels 23.6% and to allow for easy flow of storm water during rainfall. Other measures taken by residents include; seeking alternative accommodation (22.2%) and abandonment (19.4%) respectively.

Structural/Erosional damage arising from the flooding

The information in Figure 2 shows the extent of erosional/structural damages caused by flooding in the Metropolis. About 38.8% respondents say that flooding has caused their foundation to be exposed as result of frequent erosion. About, 32.2% respondents say it caused tilting/cracking of their building, while 18.6% respondents say flood water

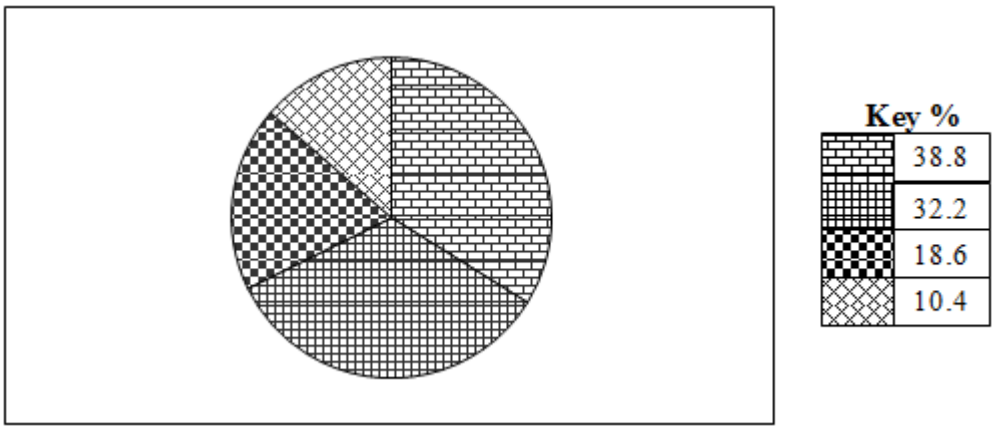

Figure 2. Structural/Erosional damage from flooding.

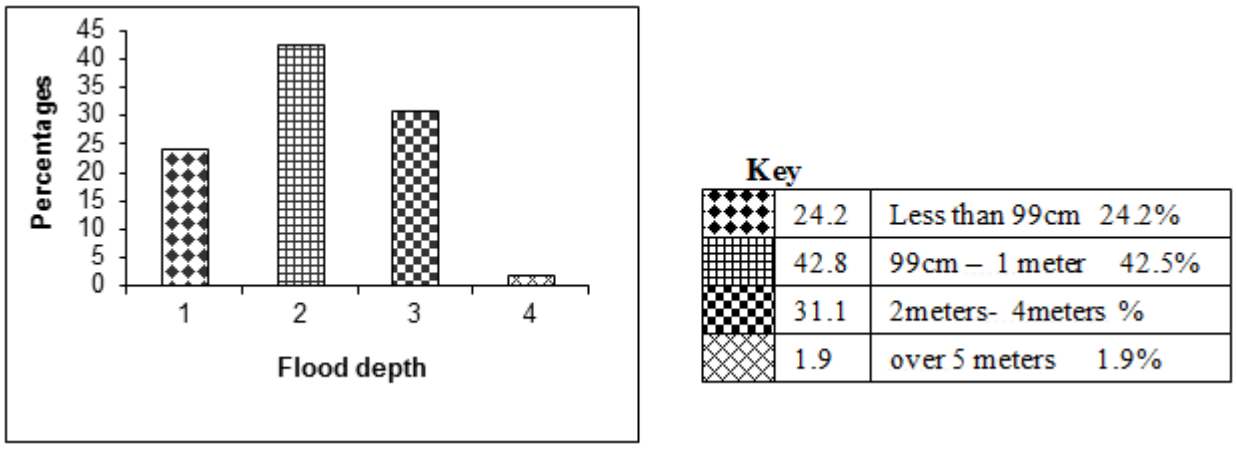

Figure 3. Flood depth.

constantly leak from the ground for months and 10.4% say the paints are worn out and the structure decays and diminishes in value. The Figure 3 shows the depth of the flood from direct measurement. About 42.5% of the respondents say the flood depth was about 99cm – 1 meter, 31.1% say theirs get to about 2 meter – 4 meters depth, while about 24.2% say the flood depth was less than 99 cm and about 1.9% say the flood depth was over 5 meters in their area respectively.

Hypothesis Testing: Sub hypothesis (i)
Ho: There is statistically significant relationship between the frequency of floods in Port Harcourt Metropolis and value of properties.
H1: There is no significant relationship.

Decision Rule accept Ho if the critical value is greater than the calculated value. Reject Ho if the calculated value is greater that the critical value.

SB1 and SB3 are highly significant. Conclusion, accept Ho at 0.01 significant level and Reject H1, thus there is a significant relationship.

Sub –Hypothesis (ii)
Ho: There is statistical significant relationship between flood frequencies and drainage conditions, location of houses and rainfall.
H1: There is non-significant relationship. Decision: Accept Ho if critical value is greater than calculated value. Reject Ho if calculated value is greater than critical value.

SB1 and SB3 and SB3 are highly significant
Conclusion: Accept Ho at 0.01 significant level

Table 8. Statistical Tests (Chi-Square).

Location	Chi- Square	Degree of freedom	Significant level	Other Statistics		
				Contingency Coefficient	Pearson's R	Significant level
SB1	** 64.10526	18	0.000	0.78471	-0.00730	0.4822
SB2	7.89116	5	0.1623	0.40592	-0.27260	0.0031
SB3	** 40.07352	18	0.0020	0.70743	0.24652	9.0626
SB4	6.90598	5	0.2277	0.38371	0.11575	0.2385

**Highly significant (P<0.01); (n=40)

and Reject HI.

From the two Sub- hypothesis drawn from the main Hypotheses for this study it can be affirmed that our assertion that drainage conditions, the location of houses and the amount rainfall are related to the frequency of flooding in Port Harcourt.

DISCUSSION

Flooding is a natural hazard which has become a prevalent problem in Port Harcourt Metropolis. Several problems were identified by the study as revealed by respondents. The problems ranged from disruption of transport and communications activities, loss of house hold items, erosion and cracks in buildings, uncontrolled waters on street surfaces and offices. About 42.5% of the respondents say the flood depth was about 99 cm – 1 meter, 31.1% say theirs get to about 2 meter – 4 meters depth, while about 24.2% say the flood depth was less than 99 cm and about 1.9% say the flood depth was over 5 meters.

Other problems identified include such factors as climate change phenomenon, topography, geology (clay soil) type of the area which does not allow for easy percolation of storm water and building structures on flood plains. About the effect on developed property value, flooded properties were abandoned; buildings become depreciated, less attractive and attracted low rent charges. Also problems of urban planning, poor site and soil analysis and urban sanitation problems were identified as causes of the flooding.

CONCLUSION

The present study has established that there is flood problem in Port Harcourt Metropolis. It has been identified flooding as an annual problem and about 51.9% of respondents agreed to this assertion. Another 43.1% also say that when the flood occurs it lasts for one month before the water dries up; the situation becomes worrisome because it could lead to disease epidemic and very serious health concern. Drainages were identified to be available, but are blocked with debris. A statistical test conducted on the degree of relationship proved that there was a very strong relationship between flood frequency and drainage condition Tables 8 and 9.

RECOMMENDATION

The study recommends that the government prepares a drainage plan for the city of Port Harcourt. Furthermore, a comprehensive drainage and infrastructural planning works to be embarked upon by the relevant agencies by way of desilting and identification of structures on flood prone areas in the Metropolis. Finally since memory of flood experience in the area was short-lived by inhabitants, like other parts of the states where such incidences have occurred e.g., Lagos state and Oyo state (Ogunpa in Ibadan), there should be an aggressive awareness or early warning signals on the coming of flood by experts (e.g., NIMET and NEMA) to alert the government and the people living in flood prone areas to be prepared.

Table 9. Statistical Tests (Chi-Square).

Location	Chi- Square	Degree of freedom	Significant level	Other Statistics		
				Contingency Coefficient	Pearson's R	Significant level
SB1	** 98.07998	36	0.000	0.8428	-0.9903	0.000
SB2	28.99875	25	0.2640	0.40592	-0.27260	0.000
SB3	** 54.44783	30	0.0040	0.75945	0.23241	9.0745
SB4	6.90598	15	0.000	0.76503	0.99586	0.000

**Highly significant (P<0.01) (n=40)

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